The Future of Fires

Modernization of the Fires Warfighting Function to Achieve Overmatch

by Maj Daniel Mahoney

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This is the third and final article in a three-part series that examines the concept of offsets to military advantages. The first article, published in January, examined the Battle of Agincourt to determine how and why England's protected firepower projection offset France's advantage in mass. The second article, published in April, took the lessons learned from Agincourt, combined them with existing future operating concepts for the Army and Marine Corps, and developed a potential way to reproduce the 15th century longbow's qualitative advantage in future war, using a novel materiel solution. The author tested this solution with an operational decision game in order to validate the concept and consider ways to improve the concept in order to account for characteristics of future combat that did not emerge from the study of Agincourt.

In this article, the series concludes by refining the initial concept to account for decision game feedback and turns to a philosophical discussion of the character and nature of war, along with possible paradigm shifts that military professionals might encounter on the journey to the future.

What modern fires capabilities could replicate the advantage of the 15th century longbowmen. *(Photo: British Museum.)*

Refined Concept

With longbows at Agincourt as a benchmark, this series recalls the analysis of protection and firepower projection from its second article in identifying how to modify the advanced artillery initial concept in order to achieve a similar level of offset to mass. While this analysis can incorporate modified or new capabilities, the evaluative function of decision game responses is not available, as the author only administered decision games for the initial concept. With that in mind, any evaluations for the modified concept are based on the author's contextually informed, yet subjective, opinion.

Design

The advanced artillery initial concept was a combination of two ideas: a semi-autonomous, highly mobile fleet of delivery platforms and the swarm-capable family of reconnaissance munitions. A revision of the initial concept now considers each of these sub-ideas in turn.

The two most applicable comments for refinement of the delivery platform are signature management and system capabilities in a real-world joint fight. Although the discussion of signature management applied mostly to the munitions themselves, one respondent identified a desire to have antenna farms or other means of confounding enemy targeting efforts for ground-based systems. The second article's analysis of protection principles identified integration and full-dimensionality as two of three principles where the initial artillery concept was less well protected than similar Russian systems. The introduction of some type of signature confusing capability, such as decoy antenna farms or signature minimization technologies, would assist in closing the gap on this relative deficiency. Finally, drones in the refined concept will not require recovery, as they did in the initial concept. This will help to preserve the location of delivery systems or recovery teams by eliminating a possible way for enemy forces to track friendly movements and

use that knowledge to enhance their targeting efforts.

To make the delivery platform more well-suited for a true joint fight, this analysis recalls the Army's Operating Concept. Long range and precision were two of the most commonly used adjectives when describing fires capabilities. While precision is largely the province of individual munitions, increasing the size of the howitzer from 105mm to 155mm or expanding the family of delivery platforms to include a type of light-weight missile delivery system would assist in extending the system's range. The loiter capability of the initial concept munition family already increases range beyond that of a conventional 105mm, but the modifications described above would extend potential range even further.

With respect to the family of munitions, several modifications would enhance the overall artillery system. First, adding a kinetic kill capability to some, or all, drones would enhance the concept by providing an organic destruction mechanism for armored targets. Like the R-series Hellfire munitions, drones in this refined concept could have both a precursor shaped charge and fragmentation sleeve on each munition, providing a targeting option for both soft and hard targets.[1] This article does not recommend a percentage of drones that should have a kinetic kill capability but rather stipulates that the capability is necessary, regardless of how it is met.

Next, a modification to signature management would greatly assist in a wide range of friendly capabilities. A low-signature capability would increase survivability of delivery platforms, individual drones, and the overall swarm by mitigating enemy targeting efforts. The ability to produce a large, or over-large, signature when desired would assist with tasks such as identifying enemy integrated air defense systems (IADS) ocations for eventual defeat or providing military deception as to the size of a friendly airborne element. Switching a signature from over-large to low observable following an ineffective enemy counter-air action could also provide a false positive for enemy targeting efforts, causing them to take an action that they might believe to be lower risk than it is in reality. In turn, this would provide an exploitation opportunity for friendly forces.

Finally, comments regarding video downlink bandwidth concerns raised by one respondent are certainly valid, especially in a contested environment where the risk of enemy electronic disruption or intercept is high. To address this concern, the refined concept maintains a video capability on board every aircraft but relies upon swarm logic to dictate which feeds are provided to the operations center and when. The refined concept will also include other forms of battlefield sensing such as ground moving target indication (GMTI), synthetic aperture radar, and others.

As with the above discussion regarding kinetic kill capability, this paper does not recommend an exact method for distributing these sensors across the swarm. Part of the advantage of the longbowman in 15th century England was his relative cost advantage compared to other types of soldiers. Adding more capabilities to each drone makes the overall cost rise, especially since there is no longer a need for recovery. An academic optimization project would likely help to identify an effective distribution of system capabilities based on swarm size and anticipated threat environments, but such a project lies beyond the scope of this series of articles.

We now return to an assessment of protection and firepower projection in order to speculate on the effectiveness of this refined concept. Since there is no decision game to test the advanced artillery refined concept, this article provides only an assessment of individual system capabilities and neglects an analysis of a composite force. However, the next section, "Character of Future Combat," will address some of the ways to employ the refined concept and how it might integrate with certain types of force compositions.

Without the benefit of peer critical analysis, all the recommended changes to the initial concept should either increase or maintain the degree of protection found in the initial concept for the advanced artillery system. Most of the improvements are the result of signature management, which should increase the swarm's survivability. The swarm's health is closely tied to delivery platform protection, so any measures taken to protect the swarm naturally protect the delivery platforms as well.

With the exception of achieving a diversion, the refined concept either maintains or enhances the initial concept's ability to achieve the identified effects of projected fires. Most of the improvements are a function of the added kinetic kill capability, which makes destruction, defeat, and deception more possible. Diversion potential does not decrease because of some deficiency in the munitions but rather because adding more capabilities to each munition, such as a warhead and a signature management system, makes each drone more expensive to produce. Even if fiscal responsibility is not an issue, the knowledge that the drones have many capabilities, as opposed to just a few, makes it more difficult for a commander to sacrifice them.

Taken together, all these refinements help to identify a collection of capabilities that a modern analogue of the 15th century longbow needs to successfully offset an advantage in enemy mass. The delivery platform should rely upon deception, speed, and a low signature in order to enhance survivability. These platforms should be part of a larger system which compensates for a relatively low degree of organic protection, benefiting from a complementary protective effect. The platform's munitions must assist in protecting the platform by drawing enemy targeting resources and must also have the capacity to achieve a wide variety of battlefield effects. These effects should run the gamut from non-kinetic effects such as deception and diversion to the highly kinetic effects of destruction and defeat. In order to aid in expanding the range of possible effects, the munitions should have variable electronic signature potential and kinetic kill potential for soft or hard targets. The strength of the swarm is reliant on its size, so the delivery mechanisms must have enough organic ordnance to deploy a sufficiently large swarm, even in austere environments.

Character of Future Combat

With a list of advanced artillery system capabilities in mind, this analysis attempts to anticipate some of the more favorable operating environments for employing the system. Having identified a proper environment, this article next suggests methods for friendly employment and potential friendly-force compositions. Finally, the article concludes with a review of combat verities in order to determine whether or not the conclusions of this analysis warrant a modification to those same verities.

Since the decision game portion of this series used a Russian opposing force, this analysis now considers a Russian operating environment. While Russia is researching several autonomous systems such as the humanoid robot to replace an individual soldier and semi-autonomous tanks, many experts also acknowledge that Russia's current military advantage in Eastern Europe means that they would not need to modernize at all in order to successfully invade and hold the Baltic states.[2] With the United States already pursuing sixth generation fighters in order to maintain air supremacy over Russian and Chinese rivals, this analysis continues under the assumption that the United States and NATO will successfully maintain an air advantage over Russian opponents, which will translate into a successful IADS defeat prior to any intervention to restore Baltic sovereignty.[3]

The ideal operating environment for the advanced artillery system and its swarm is one in which a gap in IADS coverage exists. Individual SAM and AAA weapons may persist, but the most sophisticated enemy radar and missile systems would not contribute to the fight. The enemy would likely enjoy a defensive posture, having successfully seized control of key terrain within the Baltics, and an ongoing fight for air supremacy between NATO forces and Russia.

In this operating environment, the advanced artillery system could operate from very small to very large echelons with good effect. At the very large end, the system could replace existing artillery battalions in order to provide direct support or general support. Planners would incorporate the swarm into an overall concept of fires, and air force counterparts could include it on the air tasking order, airspace coordination order, or both. Units employing the swarm would execute survivability moves just like a conventional artillery unit would and could also deploy closer to the forward line of friendly troops because of the autonomous Hawkeye's rapid ability to emplace into and displace from a firing point.

In the future operating environment, artillery could operate effectively from small to large echelons and formations. *(Photo by LCpl Preston McDonald.)*

The advanced artillery system also presents an opportunity for planners to experiment with new task organizations for expeditionary forces. For example, the Marine Corps could incorporate a platoon of advanced artillery into a counter anti-access/area denial (A2/AD) company team for rapid employment. An example task organization would be a platoon of infantry, a platoon of advanced artillery, a friendly air defense artillery (ADA) system, and a conventional unmanned aerial systems UAS. A Company team with this composition would function well because of the complementary protection afforded to the howitzers by the infantry platoon and the resulting intelligence gathering and kinetic kill capability of an expeditionary swarm. The attached friendly ADA system would protect the force from enemy counterbattery or air-to-surface fires in instances where enemy A2/AD systems attempt to contest friendly positions.

With potential employment options in mind, this series now considers the totality of the analysis done to this point in evaluating a list of combat verities. Renowned military historian COL Trevor Dupuy described thirteen "Timeless Verities of Combat" in his book *The Evolution of Weapons and Warfare*.[4] From this list, the author identified three which likely need revision based on the results of this analysis. They are that successful defense requires depth and reserves; superior strength always wins; and that firepower kills, disrupts, suppresses, and causes dispersion.

Agincourt provides a prime example of an instance where a successful defense did not require depth or a reserve. In fact, the first article in this series suggests that one of the reasons England won at Agincourt was because they had virtually no depth or reserve. Henry arrayed his forces so as to inflict as much simultaneous firepower against the enemy as possible. Holding forces in reserve or creating depth would have limited his ability to mass fires and effectively disrupt France's attack.

The best way to revise this verity is to replace the terms "depth" and

Armed drones could provide a disruptive fires overmatch. *(Photo by Cpl Daniel Benedict)*

"reserves." Both words are methods aimed at achieving a desired characteristic. It is more useful to state the verity in terms of the desired characteristic. In this case, depth and reserves provide redundancy to a defense. Based on this and the results of this series' analysis of protection, the author would re-write this verity as, "Successful defense requires redundancy and protection."

The next verity in need of revision is that "superior strength always wins." Again, Agincourt shows that this is not the case. France possessed more combat power than did England but used it poorly. By sending successive battles composed of portions of its force, France ceded its overall advantage in mass by fighting three successive micro-battles where they were actually at a relative disadvantage in overall mass. Their superior strength did not win because of a failure to take advantage of the potential to achieve an overmatch.

In the same way, respondents who played the decision game portion of this analysis widely recognized the need to disrupt Russia's force in both the current and the future scenario. Many concepts included plans to force the Russian column to deploy early or seek multiple simultaneous routes of advance. Some defensive plans even included an offensive arm where precision strikes degraded Russian combat power prior to contact with friendly forces. All these respondents recognized that strength did not matter if it could not effectively target the friendly center of gravity. For this reason, the author would re-write this verity to say, "Superior strength always wins when properly employed."

The final revision is not a criticism as much as it is an expansion of the existing definition. COL Dupuy said that "firepower kills, disrupts, suppresses, and causes dispersion." While he certainly did not intend to list out every possible tactical task or effect of fires, all the listed transitive verbs use the friendly force as the subject, and the opposing force as the direct object. As the decision game review portion of this series reveals, this is only half of the equation. Many respondents used the position of friendly units, or even the swarm itself, to draw the enemy's attention. Military deception is a much larger portion of conventional operations than it was in 1980 when COL Dupuy published his book. Emerging trends in hybrid warfare demonstrate the effectiveness of tactical tasks which run the gamut from non-kinetic to fully kinetic. As a result, this article recommends adding one more item to this verity. With revision, it would read, "firepower kills, disrupts, suppresses, causes dispersion, and draws attention." This revision emphasizes the importance of military deception while also reinforcing the axiom that "smoke draws fire."

Counterarguments and Concerns

One potential criticism of this project's recommendation is that it may be the "fruit of the poisonous tree," to borrow a legal metaphor. According to the Common Operating Precepts of Joint Operations found in *JP 3-0*, modern operations "integrate joint capabilities to be complementary rather than merely additive" and "achieve and maintain unity of effort within the joint force."[5] Because the test for this project's concept, the operational decision game, used a sterilized scenario free of the modern realities of joint combat, any conclusions drawn from the results of the test are underinformed and potentially not useful. This argument certainly has merit. The author deliberately designed the scenario to test the potential value of sufficiently protected firepower projection against mass while purposefully removing other sources of combat power from the equation. Neither force had attached engineering capability, air support, naval support, cyber capabilities, or any other source of combat power present on a modern battlefield.

The author's response to this argument is that the decision game was not meant to evaluate how well this system would operate in a fully integrated, multi-echelon joint force. The purpose of the decision game was to determine whether or not the advanced artillery initial concept could achieve the same type of offset to an advantage in mass that the English longbow did at Agincourt. If it could, the results evaluation portion of this series sought to determine if the means of achieving this offset were the same or different, and if this mattered. Although it is not a substitute for a fully developed decision game, the "Character of Future Combat" section attempted to answer the question of whether or not the advanced artillery refined concept would fit well in a modern joint environment. Based on the conclusion to that section, the answer is most likely that the refined concept has the potential to work in most operating environments that are free of a robust IADS network.

Another potential argument against the advanced artillery refined concept is that it is too reliant on a large swarm of drone aircraft for both protection and firepower projection. The absence of conventional munitions with a kinetic kill capability for moving armored targets means that it falls upon the swarm to inflict casualties when facing an armored foe.[6] Furthermore, IADS, surface-to-air missiles, and antiaircraft artillery proliferation amongst many of America's near-peer competitors means that it will be difficult to build a large enough swarm to overwhelm an enemy's defenses. Even if a sufficiently large swarm made it to a target area, a well-defended area such as Kaliningrad could reduce the swarm to an ineffective saturation level without much trouble due to the relatively exposed nature of the drones (slow and low) compared to other airborne platforms.

In response to this argument, the author acknowledges that while the advanced artillery refined concept might possess many of the same qualities as the English longbowmen, it will never be the panacea that the longbow was for nearly 100 years. With the exception of nuclear weapons, there will likely never be another combat system to achieve as disproportionately large of an advantage as the longbow achieved for England. Modern combat power, and thus modern vulnerabilities, are distributed over a much more diverse force. The loss of a single type of system might be problematic for a modern commander, but there is often a combination of other systems at his disposal, which could achieve a similar and redundant effect if needed.

With that in mind, this analysis acknowledges that even if all drones in the swarm were outfitted with low observable technologies, it is still likely that a sufficiently advanced enemy air defense network could effectively target the swarm. The advanced artillery concept is not meant to win every battle the way that longbowmen did for England during the Hundred Years' War. It is meant to offset an advantage in mass, likely in the form of armored ground vehicles. As the previous section identifies, the swarm will be more effective in some situations than in others. Furthermore, the swarm would likely deploy alongside other systems such as high-altitude precision strike aircraft and long-range missile systems, which could assist in an IADS defeat mission. Once defeated, the range of possible swarm employment options would expand for a friendly commander.

The final possible argument considered in this analysis against the advanced artillery concept is that it may be cost ineffective. As the refined concept section describes, every additional capability added to the drones likely makes them more expensive. Having more capable drones might expand a commander's options but would also make a commander less willing to sacrifice that capability, even with a virtually unlimited budget. A likely scenario to imagine is that a commander knows an enemy has a robust IADS network but cannot pinpoint exact IADS locations. The commander could deploy a swarm in order to find the location of the enemy systems as they target the swarm, but this will also deplete stores of swarm drone munitions. This situation places the friendly commander on the horns of a dilemma between a short-term gain for a long-term loss or potentially flying friendly manned aircraft into a well defended area of operations.

The advanced artillery concept is not meant to win every battle the way that longbowmen did ...

There are two possible responses to this concern. The first is that optimization of the swarm would mitigate the cost prohibitive nature of a sacrificial action such as allowing the swarm to be targeted for the purpose of increasing friendly intelligence. As the previous section discussed, part of the process for developing this project would require the need to develop several different swarm drones, each with their own set of capabilities. It would then be up to a commander and his staff to determine not only which types of drones to request for a certain campaign but then how much of each type of munition to dedicate to a specific mission within the campaign. This is relatively similar to the choice amongst conventional artillery munitions that commanders make today. One potential way to increase the range of options would be to have relatively inexpensive "slick" drones with very limited capabilities, deployed specifically to draw enemy attention in support of developing an intelligence picture. Even in an active swarm with an offensive task, a certain percentage could be "slick" in order to increase the overall swarm volume and oversaturate a potentially unexpected SAM or AAA response.

The other response to the concern over unit cost would be a much broader approach. Although it does not discuss acceptable losses in autonomous systems, the *U.S. Army Robotic and Autonomous Systems Strategy* indicates that working with autonomous systems will increase force protection by reducing human exposure to risk. It is only logical to conclude that the autonomous systems would bear that risk, since the overall enemy threat level is unlikely to decrease. Though not explicitly stated, this could suggest a strategy where commanders are more aggressive in their deployment of autonomous systems since the loss of such a system would not necessarily degrade mission accomplishment, or require a personnel recovery operation.[7] However, neither the *Marine Corps Operating Concept* nor the *Army Operating Concept* address the potential to fight in an environment where losses in unmanned systems are not only expected, but factored into the planning process. To embrace such a reality would require a paradigm shift across the department of defense. It is beyond the scope of this article to determine whether or not such a paradigm shift is necessary or even beneficial. With that said, there are certain advantages to fighting with non-recoverable systems. In Iraq, insurgents offset an advantage in coalition technology for over a decade by using IEDs. In many cases, coalition partners developed tactics and modified

their equipment to fight against weapon systems (IEDs), diverting resources that might otherwise have gone towards fighting the insurgents who emplaced them. The advanced artillery system can be thought of as an analogue to flying IEDs, forcing the enemy to divert resources to address the swarm in lieu of other forms of friendly combat power.

Conclusions

The French had every right to expect that they would win at Agincourt. They outnumbered the English, they had far more and better trained men-at-arms, they were well-nourished and well-rested, and they defended along Henry's route of retreat back to England. Yet, despite all these advantages, they suffered one of the most lopsided defeats in western military history because of a misapplication of combat power and a masterful control of both the battlefield and the battle on the part of their English opponents.

From this battle, the effectiveness of well-protected firepower projection stands out as the most relevant lesson. Running a close second is the importance of effective targeting. England benefitted from France executing poor target selection criteria at Agincourt. Although England did not intend this consequence, modern armies can learn from this by deliberately presenting an enemy force with a highly visible but less than ideal targeting option.

These two concepts contributed to the concept of the advanced artillery system. By presenting the enemy with a less than ideal target, a swarm of drones, the enemy is forced to dedicate resources such as time, surveillance, and possibly ordnance to addressing the swarm. This dedication of resources takes pressure off of primary friendly maneuver forces, even if the enemy only commits non-kinetic resources to the swarm.

Influencing the enemy's targeting decisions allows a friendly commander to mitigate risk, especially when teaming with unmanned systems such as the drones in the swarm concept. The swarm assumes more risk, leaving manned ground forces with less risk with which to contend. This in turn gives a friendly commander more options and creates the possibility to fight in a larger range of conditions and with potentially worse relative combat power ratios than he could with purely manned systems.

One of the largest obstacles to the implementation of such a system is the current paradigm of combat power preservation and general risk aversion within the U.S. military and government. In order to fully reap the benefits of a concept such as the one discussed in this series, future doctrine and leader philosophies may need to embrace phrases such as "acceptable losses" or even "planned losses" when referring to unmanned systems. Success on the battlefield of the future may depend on a willingness to sacrifice inexpensive systems in order to gain a temporal advantage, deplete enemy resources, or even to improve intelligence estimates.

The advanced artillery system concept is not a cure-all for any future combat scenario. It is a system designed to offset an advantage in enemy mass. This enemy mass could be manned, unmanned, or both. This system is also not designed to offset other advantages such as air superiority, cyber dominance, or control of the information environment. A multi-dimensional approach to future warfare will likely require innovative solutions to offset potential enemy advantages in these disciplines, along with many others. While preparation for any possibility is always the goal, that goal is not always feasible. It is only through continued study and forecasting that friendly forces can avoid complete surprise in combat.

Notes

1. Joakim Kasper Oestergaard Balle, "AGM-114 Hellfire Missile," *Aeroweb,* (April 2015), available at http://www.fi-aeroweb.com.

2. John Dyer, "Ivan the Terminator: Russia Is Showing Off Its New Robot Soldier," *Vice,* (May 2016), available at https://news.vice.com; and Andrew Williams, "Russian Military Unveils T-14 Armata Semi-Autonomous Tank," *Robot Business Review*, (July 2015), available at https://www.roboticsbusinessreview.com.

3. Kyle Mizokami, "U.S., NATO Already Planning the Next Generation of Fighter Jets," *Popular Mechanics*, (September 2016), available at http://www.popularmechanics.com.

4. Dupuy, *The Evolution of Weapons and Warfare*, (Cambridge, MA: Da Capo Press, 1990). His verities of combat are:
   1. Offensive action is essential to a positive combat result.
   2. Defensive strength is greater than offensive strength.
   3. Defensive posture is necessary when successful offense is impossible.
   4. Flank or rear attack is more likely to succeed than frontal attack.
   5. Initiative permits application of preponderant combat power.
   6. Defenders' chances of success are directly proportional to fortification strength.
   7. An attacker willing to pay the price can always penetrate the strongest defense.
   8. Successful defense requires depth and reserves.
   9. Superior strength always wins.
   10. Surprise substantially enhances combat power.
   11. Firepower kills, disrupts, suppresses, and causes dispersion.
   12. Combat activities are slower, less productive, and less efficient than anticipated.
   13. Combat is too complex to be described in a single, simple aphorism.

5. Department of Defense, *Joint Operations, JP 3-0*, (Washington, DC: Department of Defense, 2017).

6. In the future, modifications to the Excalibur munition could fill this gap. If the munition were scaled down to a 105mm variant, given an added laser guidance capability, and equipped with a shaped charge warhead, this would provide a redundant kinetic kill capability to the advanced artillery system. However, without these changes, the Excalibur lacks the requisite guidance system and armor penetration capability to serve as an effective substitute.

7. Maneuver, Aviation, and Soldier Division Army Capabilities Integration Center, *The U.S. Army Robotic and Autonomous Systems Strategy,* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2017).